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NCEH History

In 1980, as an expression of its commitment to solving health problems related to the environment, CDC established the Center for Environmental Health to focus on preventing disability, disease, and death due to environmental factors. In 1987, CEH was given responsibility for nonoccupational injury control programs and renamed the Center for Environmental Health and Injury Control. In 1991, National was added to the center's name to reflect the breadth of its activities.

By 1992, the injury program had grown so much that CDC decided to reorganize NCEHIC into two centers: the National Center for Injury Prevention and Control and the National Center for Environmental Health. NCEH retained the mission to carry out a national environmental health program and is now a leader in determining the health effects on humans of numerous environmental hazards -- both technologic and natural.

NCEH has had many successes. Among them are its achievements in focusing national attention on the problem of childhood lead poisoning, in developing guidelines for preventing spina bifida, and in devising new methods for measuring toxins in humans. In this section we list some of the highlights.

Air Pollution

Asthma

1994

In collaboration with the Emory University School of Medicine, completes a study of ambient ozone exposure among indigent, predominantly black children and finds that the number of hospital visits for asthma or reactive airway disease is 37% higher on days following high ozone days.

1995

In collaboration with the California Environmental Protection Agency, completes a study of the environmental determinants of asthma. Findings show an association between shortness of breath and ozone and PM-10.

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Environmental tobacco smoke

1994

In collaboration with the California Department of Health Services, completes a preliminary study of adverse reproductive outcomes associated with exposure to ETS. Results indicate an association between women's exposure to ETS and their risk of having low birth weight babies.

1995

- Determines that children exposed to ETS have a higher incidence of acute respiratory illnesses and chronic respiratory diseases than do children not exposed to ETS.
- In collaboration with OSH, investigates the source and measures levels of methyl isothiocyanate, plasticizer contaminants, and several volatile organics. Finds various levels of these components in cigarette tobacco.
- Analyzes samples from NHANES III for serum cotinine and finds that about 92% of the U.S. population has detectable levels of this metabolite of nicotine, a marker for active and passive exposure to ETS.

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Gasoline additive (MTBE)

1993

Completes studies of human exposure to a new oxygenated gasoline in Alaska, Connecticut, and New York. Results show new human exposure to MTBE (a gasoline additive).

1994

As a followup to the MTBE studies in Alaska, Connecticut, and New York, collaborates with EPA to evaluate the pharmacokinetics of MTBE and its primary metabolite, TBA, after subjects were exposed in a specially designed chamber. Finds that MTBE has a short half-life but that TBA blood levels rise and decline more slowly.

1995

Compares air samples taken during winters of 1986 to 1988 with air samples taken during winters of 1989 to 1991 and determines that areas that used oxygenated fuels had a greater decrease in carbon monoxide concentrations than areas that did not use such fuels.

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Biomonitoring: Measuring Toxicants in People

1980-1995

Develops and applies sensitive analytical methods for measuring more than 250 toxicants in people, thus obviating the need for policy makers and regulators to estimate the human health effects of exposure to toxicants on the basis of animal studies or environmental measurements. Policy makers can now base their decisions on accurate information rather than on extrapolations or intuition. These toxicants are lead, cadmium, mercury, uranium, thorium, many other metals, 144 dioxins and furans, environmental tobacco smoke, 20 polychlorinated biphenyls, 42 pesticides, 32 volatile organic compounds, and 19 polyaromatic hydrocarbons.

1995

- Establishes reference range measurements in urine for chromium and all the elements measured using the multi-element method developed in 1994. This information will be used for interpreting urine levels for health studies of exposure.
- Completes exposure study measuring levels of benzene, toluene, m-/p-xylene, ethylbenzene, and other VOCs in people before and after they pumped gasoline in Fairbanks, and Anchorage, Alaska. Results indicate that people incur a significant exposure to these VOCs, including benzene, when they pump their own gasoline.
- In collaboration with EPA and NIEHS, measures pesticide exposure in agricultural sprayers and their families living in North Carolina and Iowa. Results show that the internal dose levels of the people who applied the pesticides increased after spraying and that some family members who were not directly involved with the spraying operation also had above-background levels.
- Develops faster, more efficient methods for measuring dioxins, PCBs, and selected chlorinated hydrocarbon pesticides. These methods improve turn-around time and reduce the costs and the amount of biologic material required to make measurements.
- Begins National Human Exposure Assessment Survey to assess human exposure to toxic substances in the United States. NCEH is measuring levels of VOCs, pesticides, lead, cadmium, and other metals in human blood and urine; EPA is measuring environmental levels of these toxicants. The survey is unusual in that both biological monitoring and environmental monitoring measurements will be available for in-depth analysis when the final data are complete.

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Birth Defects

Spina bifida and anencephaly

1987

Publishes study results that show a possible relationship between mothers' periconceptual use of multivitamins and a decrease in the risk for neural tube defects among their offspring.

1992

Publishes Recommendations for the Use of Folic Acid to Reduce the Number of Cases of Spina Bifida and Other Neural Tube Defects.

1993

In China, begins ongoing study of the role of folic acid in preventing spina bifida. Women who enroll are given a supply of folic acid tablets (0.4 :g per day). A surveillance program will monitor the occurrence of birth defects among the offspring of enrolled couples.

1995

- Sponsors the conference Time for Action: Prevention of Spina Bifida and Anencephaly. Participants called for CDC to act as a clearinghouse for distributing information on planning, problems, and successes of state-run prevention programs.
- Publishes MMWR article on the effect of prenatal diagnosis of anencephaly and spina bifida on surveillance for these defects. The percentage of affected pregnancies that were electively terminated after prenatal diagnosis ranged from 9% in Arkansas to 42% in Atlanta and Hawaii.

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Human immunodeficiency virus (HIV)

1995

Develops a laboratory method to measure the antiviral drug, zidovudine (ZDV, AZT) in dried blood spots. Clinical trials show that ZDV taken during pregnancy and labor reduces the perinatal rate of HIV transmission from 28% to 8%. PHS guidelines released in the summer of 1994 recommend that ZDV be given to HIV-positive pregnant women and their newborns. Results indicate that issuing the PHS guidelines led to a marked increase in the number of HIV-positive pregnant women who are accepting ZDV therapy to reduce the risk of HIV transmission.

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Other birth defects

1980

Investigates a cluster of metabolic alkalosis among infants. Results (1) show that the cause is an infant formula deficient in chloride and (2) lead to the passage of the Infant Formula Act.

1985

Studies fetal damage caused by mothers' use of retinoic acid, a derivative of vitamin A used for skin problems. Results lead manufacturer to begin more education programs for physicians and to institute surveillance for adverse reproductive outcomes among women using the drug.

1994

Conducts a multistate case-control study of the presence of birth defects among infants whose mothers underwent CVS. Results show a six-fold increase in the risk for deformed or missing fingers and toes among infants whose mothers underwent the procedure during the 8th through 12th week of pregnancy.

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Cruise Ship Sanitation

1986

Re-establishes the Vessel Sanitation Program to meet new responsibility for conducting sanitation inspections on cruise ships.

1987

Restructures VSP as a cooperative effort between industry and government. Publishes fee schedule for inspections in the Federal Register.

1994

Investigates the first known outbreak of Legionnaires disease associated with the use of recreational spas on a cruise ship. Conducts a public hearing and publishes recommendations to minimize transmission of Legionnaires disease from whirlpool spas on cruise ships.

1995

- Publishes Shipbuilding Construction Specifications for Passenger Vessels Destined to Call on U.S. Ports
- Report in JAMA documents a reduction of outbreaks from 8 per 10 million passenger days in the 1970s to the current rate of 2 per 10 million passenger days.

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Demilitarization of Chemical Weapons

1985

Is assigned responsibility within HHS (1) for reviewing the Army's plans for disposing of lethal chemical weapons and (2) for making recommendations for protecting public health and safety during disposal.

1988

Develops a course on the medical management of chemical exposures and presents it to health care personnel in areas surrounding facilities that contain lethal chemical weapons.

1992

Inspects the incinerator that destroys lethal chemical weapons at Johnston Island and ensures that no detectable agent is released during the destruction of 682,000 pounds of nerve and mustard gases.

1993

Convenes expert panel to review Army models to describe how agent is dispersed into the air. Review results in our having to expand the size of the areas that would be affected in the event of a release of agent, which further results in our refining the plans to protect the health of the affected public.

1994

Coordinates development of recommendations for personnel protective equipment ensemble suitable for use by civilian emergency workers during agent releases.

1995

- Publishes, in the Federal Register, community medical readiness guidelines for emergencies involving the release of chemical agents.
- By 1995, with oversight from CDC, the Army has destroyed more than 2,000,000 pounds of chemical agent without any measurable release into the environment.

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Developmental Disabilities

Down syndrome

1994

Collaborates with 17 state health departments on study of trends related to Down syndrome. Results show an overall prevalence of 9.2 cases per 10,000 live-born infants. The rate for Hispanics was 11.8; for whites, 9.2; and for blacks, 7.3.

1995

Begins two epidemiologic studies (in response to a California study that found a large reduction in the risk for cerebral palsy among VLBW infants with intrapartum exposure to magnesium): a cohort study of VLBW survivors and a case-control study of cerebral palsy. Cohort study results support the findings of the California study and also suggest that magnesium may protect against other adverse developmental outcomes, such as mental retardation.

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Fetal alcohol syndrome(FAS)**1994**

Completes the Alaska Fetal Alcohol Syndrome Prevalence Study. Findings show an overall FAS prevalence of 0.8 per 1000 live births for 1977-92. The overall rate for Alaskan Natives is 3 per 1000; for the rest of the Alaskan population, it is 0.2 per 1000.

1995

- Publishes four reports in the MMWR: one shows that the rate of FAS continues to increase and is now about 6.7/10,000 births. The other reports deals with surveillance issues and the characteristics of women who drink alcohol while pregnant. Together, reports illustrate the complexities of setting up prevention programs for FAS.
- Sponsors a seminar on using brief interventions to prevent FAS. Reports show that brief counseling (e.g., by a woman's primary care physician) is more effective than no counseling and often as effective as extensive treatment. Now determining how to incorporate brief interventions into prevention programs.

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Surveillance**1984**

Begins the ongoing Metropolitan Atlanta Developmental Disabilities Study. Develops a method of conducting developmental disabilities surveillance by using school records. Produces first population-based prevalence data for mental retardation, epilepsy, cerebral palsy, and hearing and vision impairments.

1993

Determines that the prevalence rate of developmental disabilities among U.S. children is approximately 17%.

1995

Publishes results of a study of the prevalence of mental retardation among 10-year-old children living in the five-county metropolitan Atlanta area in the mid-1980s. Findings indicate that, among black children, the prevalence of both mild mental retardation and severe mental retardation is two to three times higher than among white children. Further study indicates that about half the increased prevalence of mild mental retardation among black children correlates with their maternal sociodemographic risk factors such as lower economic status and lower education levels. Full results published in the American Journal of Public Health, March 1995.

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Disabilities Prevention**1988**

Awards the first DPP grants to nine states and four institutions for projects to prevent secondary disabilities.

1990

Cosponsors and convenes a colloquium on preventing secondary disabilities among people with spinal cord injuries. Published proceedings discuss epidemiology, clinical research, prevention, and care. 1991

- Under contract from NCEH, IOM completes disabilities study and publishes *Disability in America: Toward a National Agenda for Prevention*. Results show that 35 million Americans have disabling conditions and that the annual costs in medical care and lost productivity associated with disability is almost \$200 billion.
- Convenes a national conference on the prevention of primary and secondary disability.

1992

Increases the number of state disability prevention projects to 28 and adds 5 university- or hospital-based demonstration projects.

1994

- Cosponsors two conferences: *Preventing Secondary Conditions Associated with Spina Bifida or Cerebral Palsy* and *Preventing Disabling Conditions: The Role of the Private Sector*.
- Awards two new capacity building projects for a total of 30.

1995

Cosponsors a joint workshop in St. Louis with newly established Association of State and Territorial Disability Prevention Programs.

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Drinking Water

1994

Designs a survey study of water contamination in private wells resulting from the 1993 flooding in nine Midwestern states (Midwest Well Water Survey) and analyzes results. Samples from more than 8,000 wells are analyzed for coliform or E. coli contamination. Preliminary results show that of 5,494 wells, 2,242 have positive coliform counts, and 515 have positive E. coli counts. A followup survey is planned.

1995

- Performs statistical analysis of the data gathered during Midwest Well Water Survey. Results provide convincing evidence that flooding led to bacterial contamination; however, the type of well construction is highly correlated with bacterial contamination.
- Conducts an epidemiologic study of the health effects associated with sulfates in drinking water in South Dakota. Findings result in Congress including an amendment to the proposed drinking water bill requiring CDC and EPA to conduct research on the health effects of sulfates in drinking water.

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Emergency Response to Disasters

1989

Assists in investigations in Puerto Rico and South Carolina after Hurricane Hugo. Results show that most deaths occur before a hurricane (from drownings due to flooding) or after a hurricane during clean-up (from, for example, puncture wounds, chain-saw lacerations, or electrocutions).

1990

Investigates the effect on human health of the worst tornado in northern Illinois history. Results suggest that old houses are more protective than new houses and one-story houses are more protective than multistory houses.

1992

Coordinates the public health response to hurricane-associated emergencies in Florida, Louisiana, Hawaii, and Guam. Through the Emergency Storm Relief Grant, awards \$7.5 million for recovery operations.

1993

- Responds, on behalf of CDC, to the Midwest flood, which had a significant adverse effect on public health in nine states.
- Assists in conducting a rapid assessment and a public health surveillance after the Northridge earthquake in Los Angeles, California.
- Provides epidemiologic and other public health assistance to Iowa, Kansas, and Missouri after catastrophic floods during the summer of 1993. Analysis of flood-related morbidity shows ocular, dermatologic, and musculoskeletal injuries to be common injuries sustained during floods.

1995

Assists the Illinois Department of Public Health in investigating over 400 heat-related deaths in the Chicago area. NCEH's recommendations for preventing such deaths in the future were included in Chicago's plan for a citywide response to future heat waves.

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Eosinophilia Myalgia Syndrome (EMS)**1989**

Establishes national surveillance and conducts epidemiologic studies of the national epidemic of EMS, which was linked to the ingestion of a food supplement containing L-tryptophan.

1992

Follow-up study of patients of a South Carolina psychiatrist shows that the symptoms of most patients were greatly improved 2 years after onset of illness.

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Genetics**1994**

In collaboration with NCHS, establishes a DNA specimen bank. Stored are about 17,000 specimens suitable for later amplification by the polymerase chain reaction and 7,500 cell lines suitable for direct DNA analysis. The DNA samples are representative of the U.S. population and will be used in future investigations to (1) establish national prevalence data for DNA variants, (2) establish the relationship between specific variants and disease, and (3) help researchers understand genetic factors that relate to a host's susceptibility to environmental exposure to toxicants.

1995

- Conducts a genetic risk factor study at the annual meeting of the Spina Bifida Association of America (SBAA) to look for the presence of a variant of a specific gene involved in the metabolism of folic acid and to compare the occurrence of that gene in individuals with spina bifida and their immediate family members with its occurrence in the general population. Group results will be delivered to SBAA, and NCEH researchers will discuss their findings at the next annual meeting.
- Identifies a variant of the gene that encodes the enzyme methylenetetrahydrofolate reductase, which is present with significantly greater frequency in a group of fetuses with neural tube defects.
- Isolates a fragment of the gene that encodes the enzyme methionine synthase, which may be a risk factor for vascular disease and birth

defects.

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International Environmental Epidemiology

Toxic oil syndrome

1981

At the request of the Spanish government, assists with the investigation of TOS. Results show that aniline concentrations in rapeseed oils were highly correlated with illness-related oil.

1995

Provides consultation and expands laboratory research into the etiology of TOS; identifies more than 25 new compounds that are associated with TOS.

Dioxin, PCB, and chlorinated hydrocarbon pesticide exposure

1995

Analyzes the serum of former workers at a Boehringer plant in Germany, workers at a phenoxyacid herbicide plant in Holland, and residents of the Slovak Republic to assess the relationship between the level of toxicants and the prevalence of disease and to compare the levels of toxicants among populations.

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Dioxin exposure in Seveso, Italy

1988

Begins ongoing studies with the Italian government on human exposure to dioxin among the population in Seveso, Italy, where an industrial explosion occurred in 1976. Results to date show highest levels of dioxin ever measured in people. Except for chloracne, adverse health effects are not apparent. The possibility of cancer being a long-term outcome of such high exposure remains under evaluation.

1993

Measures dioxin in the blood of residents of Seveso, Italy. This study follows up on one conducted after an industrial explosion in 1976; its purpose is to assess the persistence of dioxin in people.

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Oil fires in Kuwait

1991

Investigates VOC exposure of fire fighters involved in putting out oil fires in Kuwait. Finds that their levels of many VOCs were higher than background levels.

Optic neuropathy in Cuba

1994

- In response to an urgent request from the Cuban government, collaborates with NCCDPHP, Emory University, the Pan American Health Organization (PAHO), and the Cuban government on a study of an epidemic of optic neuropathy in Cuba affecting more than 50,000 people..
- Analyzes urine and serum samples of 300 people for biochemical markers of their nutritional status, smoking status, and health status, and for markers of exposure to heavy metals and organic toxicants. Findings indicate that poor nutrition and smoking are associated

with optic neuropathy.

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Lead Poisoning

1981

On the basis of 12,000 blood lead measurements made for NHANES, identifies lead in gasoline as an important source of human exposure to lead. Works with EPA to enact regulations for removing lead from gasoline. Decision to remove lead is based largely on data compiled by NCHS and CEH.

1991

Develops the Strategic Plan for the Elimination of Childhood Lead Poisoning, which is released by HHS.

1991

Revises and releases CDC's statement Preventing Lead Poisoning in Young Children. Makes 15 grants to state and local agencies to screen for lead poisoning; these agencies screen about 300,000 children for lead poisoning.

1992

More than doubles the number of state and local grants (31) but more than triples the number of children screened (one million) over 1991.

1993

Again increases the number of state and local grants (29 state and 8 local health agencies). These agencies screen more than 1.7 million children for lead poisoning and find nearly 75,000 children with elevated blood lead levels.

1994

- With HUD, supports the NeighborhoodBased Childhood Lead Primary Prevention Program. This program is the first to fund neighborhood attempts to find and demonstrate ways that government, community organizations, and others can work together to keep children from becoming poisoned by lead.
- Awards 37 continuation State and CommunityBased Childhood Lead Poisoning Prevention Grants. More than 1,500,000 children are screened for elevated blood lead levels. Of those screened, more than 54,000 are confirmed to have elevated blood lead levels and are referred for medical and environmental interventions.

1994

Blood lead levels measured in NHANES show major success of public health efforts to reduce lead in gasoline and lead in soldered food cans, resulting in a dramatic 78% decrease in blood lead levels for the U.S. population. The percentage of children with blood lead levels at or above 10 ug/dL also fell sharply, from 88% in NHANES II (1976-1980) to 8.9% in NHANES III, Phase 1 (1988-1991).

1995

- Designs a targeted screening strategy to improve the effectiveness and efficiency of screening young children for elevated blood lead levels.
- Expands to 26 states the electronic national surveillance system for elevated blood lead levels among children.
- Offers blood lead reference materials, training, and consultation to state, local, academic, and private laboratories to improve the precision and accuracy of blood lead measurements in almost 300 laboratories.

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Medical Examiner/Coroner Information Sharing

1987

Establishes the ME/C Information Sharing Program to improve the quality of data on death certificates and to increase the availability of those data for scientific research.

1989

Studies ME/C data in South Carolina after Hurricane Hugo. Results show that no universally accepted definition of a hurricane-related death was used.

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Methyl Parathion Exposure

1994

Responds to request from Ohio health officials, who reported that hundreds of residences were sprayed with methyl parathion by an unlicensed and uncertified pesticide applicator. Contact, inhalation, or ingestion of the pesticide can cause serious illness, even death. A full-scale study of 200 exposed residents is under way to determine the long-term health effects.

1995

- Serves as consultant to a medical board that is established to monitor future health effects of the exposed population.
- Develops a new method and analyzes urine samples from residents of Lorain County, Ohio, for methyl parathion to determine whether to relocate families and clean dwellings in this Superfund remediation site. Information obtained from a timely analysis is used to develop a clean-up protocol for the dwellings.

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Radiation

1993

- Awards grants for two extramural radiation studies: (1) a report on historical dose reconstruction and epidemiologic studies and (2) uncertainty analysis in dose reconstruction.
- Awards contracts to eight American Indian tribes in the Northwest for collecting and analyzing data on radiation exposure due to emissions from the DOE facility at Hanford, Washington.
- Implements a plan to involve the public in dose reconstructions and epidemiologic studies at nuclear facilities.

1994

- Releases findings of doseestimate reports for the air and for Columbia River pathways from the Hanford Environmental Dose Reconstruction Project in the State of Washington. Radiation doses to the thyroid glands of infants and children who lived directly downwind of Hanford and who drank milk from 1945 through 1951 are estimated to be much higher than radiation doses occurring naturally in the environment.
- Releases results from the pilot study for the Hanford Thyroid Disease Study. These results indicate that a full epidemiologic study of thyroid disease and exposure to radioactive iodine emissions from the DOE Hanford Nuclear Facility is feasible and should include 3,200 people who were born near the facility from 1941 through 1946. The study is under way.

1995

- Collaborates with Yale University, VA, the Connecticut Department of Public Health & Addiction Services, and ASTE on a workshop on the public health response to nasopharyngeal radium irradiation to veterans and citizens from the 1940s to the mid 1960s.
- National Research Council Committee on an Assessment of CDC Radiation Studies sponsored by the Radiation Studies Branch, publishes A Radiation Dose Reconstruction for Epidemiologic Uses -- a comprehensive guide for structuring studies of historical radiation exposure.

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Standardization, QA, and QC Laboratory Programs

Cholesterol

1985

Participates in the Laboratory Standardization Panel of NCEP to develop national standards for improving measurements of cholesterol in clinical laboratories (1985 through 1990).

1988

Establishes a network of cholesterol reference laboratories (10 domestic and 4 international) to improve the accuracy and precision of cholesterol measurements. Goal is to achieve the Healthy People 2000 objectives.

1993

To ensure measurement quality, collaborates on standardizing lipid measurements with 140 national or international laboratories involved in research on coronary heart disease. These laboratories collaborate in more than 100 major federal- or state-funded clinical trials and epidemiologic studies of risk for cardiovascular disease and of the relationships between (1) such risk and genetic or nutritional factors and (2) such risk and other chronic diseases such as diabetes.

1994

Evaluates a cholesterol testing device that results in FDA approval as the first home test for cholesterol.

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Multi-element reference material

1995

Under an interagency reimbursable agreement with NIST, produces a new multi-element standard reference material (SRM) containing certified levels of 18 key elements, including for the first time, uranium, thorium, thallium, vanadium, and molybdenum in lyophilized human urine. This material will be the accuracy standard in the United States for laboratories that measure these elements in urine to characterize the extent of human exposure for health studies.

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Newborn screening

1976

CDC begins the ongoing national quality assurance programs for state laboratories that use dried blood spots to screen for metabolic disorders and other disease and health conditions. Examples include congenital hypothyroidism, phenylketonuria, galactosemia, maple syrup urine disease, HIV, and sickle cell disease.

1987

Develops and implements a quality assurance program for laboratories that use dried blood spots to screen newborns as part of the multiyear HIV seroprevalence survey among childbearing women.

1991

Develops and implements a national performance evaluation program to support the states' newborn screening tests for sickle cell disease and other hemoglobinopathies.

1994

Develops and validates an immunoassay method of measuring drugs of abuse in dried blood spots routinely collected from infants and transfers the assay for measuring a metabolite of cocaine to the New York State Department of Health for use in a pilot study of a highrisk population.

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Vietnam Veterans

1984

Publishes Vietnam Veterans' Risk for Fathering Babies with Birth Defects, which indicates that Vietnam veterans are not at higher risk than other veterans or nonveterans of having children with birth defects.

1987

- Results of Agent Orange Validation Study show similar dioxin levels among veterans who were ground troops in Vietnam and veterans who did not serve in Vietnam.
- Publishes preliminary results of a study of Ranch Hands (veterans who sprayed Agent Orange in Vietnam). Some were unduly exposed to TCDD. Study continues to 2002.

1988

Releases reports on the physical, psychological, and reproductive health of U.S. Vietnam veterans (Vietnam Experience Study). Finds that conditions such as post-traumatic stress disorder, alcohol abuse, and depression are somewhat more prevalent among Vietnam veterans.

1989

Releases report of the Agent Orange Validation Study, which shows no association between serum dioxin levels among U.S. Vietnam veterans and their various estimated levels of exposure while in Vietnam.

1990

Publishes results of the Selected Cancers Study, which show that Vietnam veterans appear to be at increased risk for non-Hodgkin's lymphoma but not for other forms of investigated cancers. Increased risk does not appear to be due to exposure to Agent Orange.

1993

In collaboration with the U.S. Air Force, assesses the body burden of dioxin in Ranch Hand veterans during their third medical examination in 1992. A full analysis of the relationship between dioxin levels and adverse health effects will be completed in 1994.

1995

Collaborates with the Air Force to characterize the dioxin exposure of Air Force veterans of Operation Ranch Hand. Exposure classification based on veterans' job classification and self reports of the duration of on-skin exposure agrees well with exposure classification based on serum dioxin levels.

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